CLASSIFICATION

SUBJECT: SAMOS Program

1. General Background Information

A. During the past several months, deliberations concerning the R&D aspects, the operational control, operational and/or intelligence requirements, data reduction and dissemination, location of facilities, technical capabilities and limitations, relationship to other collection systems, organization, etc. have taken place. The following comments summarize the highlights of the above mentioned deliberations:

(1) The situation must be such that the program will be politically acceptable on a national and on an international basis. This includes: favorable indoctrination of the public, operational and/or executive control by an organization that will lend itself to the promotion of the peace time utilization of SAMOS as well as to the expeditious and effective exploitation of the end results.

(2) The R&D and operational aspects of SAMOS are national in nature in that the government can only afford one program and the end results are of priority interest to the entire intelligence community. Maximum utilization must be made of the many economic and civilian uses of the end results, such as peace time inspection, humanitarian, engineering and disaster surveys on a world-wide basis and the contributions that the program will make to space science. All of the above indicate that the program should be under the executive control of a national or joint organization that has an international growth potential.

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(3) Political approval to accomplish satellite reconnaissance will depend on the degree that the above conditions are met. It is felt that the military and civilian requirements as to type of coverage are compatible in that they can both be met at the same time and with the same equipment. The peaceful uses and propaganda value of the end results may be the crux of the political approval problem. By the same token, the civilian uses of the end results would serve as cover for obtaining permission to obtain the more detailed military type of information. An additional cover would be the combining of scientific packages with a camera in a larger vehicle.

(4) The program appears to be based on unrealistic operational and intelligence requirements and exaggerated claims as pertains to system capabilities. Information concerning the program has not been made readily available to the national intelligence community and the relationship of the program to all of the other reconnaissance intelligence programs is not known. It is felt that all of the above, coupled with an unwarranted emphasis on an early operational system, has retarded the research and development aspects of the program as well as the possibility of early availability of useable end products. The SAMOS intelligence requirements are based on a capability rather than the job to be done for a specific time period. The performance of the E-2 package is such that it degrades the advantages that are inherent in satellite type of operation and requires very complex data reduction equipments that would not normally be required.

(5) Effective and expeditious exploitation of the SAMOS material requires that the data reduction be accomplished simultaneously by all interested agencies utilizing reference material from all available sources and programs. Emphasis by the individual agencies will be consistent with their priority area of interest and assigned roles and missions. This indicates that existing facilities and agencies should be used or that immediate action should be taken to prepare an adequate facility to accomplish this job.

(6) The USAF has attempted to solve the peace time reconnaissance problem in the same manner that it has coped with war time reconnaissance. As a result, it has not been flexible enough to react on a timely enough basis to changing concepts: changing political situations; technological advancements; required changes in programming; appropriations; organization, procurement, etc.

(7) Other factors are special project clearances, lack of continuity of experienced Hqs. staff personnel, lack of established R&D contacts with other organizations active in the field and the lack of a single and fully knowledgeable office of responsibility within Headquarters, USAF.

B. Recommendations:

(1) That executive responsibility of SAMOS be placed under the executive control of the JCS or a civilian agency.

(2) That the R&D phase and the operational phase of SAMOS be one and the same. That the USAF (ARDC) should continue R&D in this area in response to national and JCS stated operational-intelligence requirements.

(3) That the possibility of accomplishing data reduction at the Satellite Tracking Center (Sunnyvale, California) by a joint organization composed of all interested intelligence agencies be investigated. This would eliminate the Omaha early fix from the program.

(4) That the possibility of utilizing the Reconnaissance Technical Squadron facilities at Westover AFB, and all other existing facilities, as a national processing and data reduction center be investigated.

(5) That special emphasis on an expedited basis be placed on the evaluation of Subsystem I. An expedited simulation program with full participation by the intelligence community is indicated. Due to long development time, the state of the art has surpassed certain Subsystem I components and reevaluation of a number of items of equipment is indicated. Sophistication and complexity of Subsystem I equipment versus the relative simplicity and capabilities of conventional equipments should be investigated on an item for item basis.

(6) That an up-to-date statement of satellite reconnaissance-intelligence requirements be prepared and made known to the community. The type, amount, and frequency of coverage required for specific time periods should be stated.

(7) That the compatibility of civilian and military satellite reconnaissance requirements be studied. The study to include frequency of coverage, types of coverage, timing of flights, timing of release of end results, application to civilian uses, manner of release, utilization instructions, etc.

(8) That each Headquarters, USAF staff agency have at least one fully knowledgeable and cleared individual working in this area on a full-time basis and that this individual be a member of the USAF Reconnaissance Committee of the Aircraft and Weapons Board. That a single office of responsibility for USAF reconnaissance-intelligence activities be established within the DCS/O.

2. Political Considerations

A. (1) In order to preclude the possibility of controversial issues resulting in unfavorable and/or untimely publicity; joint participation and support by all agencies active in the area of interest is necessary. This includes active participation of the entire intelligence community in the research, development, personnel training, and evaluation in the various aspects of the program and particularly the evaluation of the end results - joint participation and support of the program would eliminate much of the existing criticism and indecision and result in expeditious action being taken in problem areas as they arise.

(2) The Operations Coordinating Board (OCB) has prepared an Operations Plan for Outer Space in order to provide guidance for agencies participating in the national space program. The question of the political frame-work for reconnaissance satellites was considered as part of the above. The following task was assigned to the State Department and accepted. "In anticipation of the availability of reconnaissance satellites, study and proposed actions which will place the uses of U.S. reconnaissance satellites in a political and psychological context most favorable to the U.S." The Department of State has set up a committee to discuss the issue with various interested agencies.

(2b) The USAF has notified this office that studies by the military departments and the Joint Staff are underway to determine the possible application of satellite-produced information to civil purposes and to evaluate each such application for its implication to military, political, and psychological objectives of the United States.

It is felt that the study should include such things as:

(1) Under what political conditions launchings should be made.

(2) The type of coverage that could be released, the timing of the release, and indicate areas of the world that should be covered and released for political reasons.

(3) To what international agencies the material should be released to, to include timeing as well as the types of coverage.

(4) The timing and kinds of publicity, domestic and foreign.

(5) Plans for degrading classification and releasing of coverage to other countries.

(6) Study all types of future international participation.

(7) Time phasing for all of the above.

3.(a) It is felt that detailed discussions should be conducted pertaining to the R&E and operational aspects visa vis policy and the relationship of the Department of Defense and the State Department respectively. At the present time SAMOS is a research and development program aimed at obtaining fundamental data necessary for system design, as well as for future operational employment. It is not known what the quality or quantity of the different payloads will yield and what degradations will occur due to physical phenomena, electrical transmissions, in-flight processing, ground read-out, the time it will take to obtain the desired amount and type of coverage, the spectrum and level of detail of information that can be extracted, reliability, etc. The early flights are component test flights and more than likely the results could not be released without possible harm to our prestige because of their early research and development character. Russian achievements viz their Lunar shot is a consideration in this area.

3.(b) It is recommended that a small and flexible, joint working group composed of OSDDR&E and Department of State, become active in this area as soon as possible. Participation of the other DOD and/or national agencies would be by invitation and based on their ability to contribute to Ad Hoc type problems. It is felt that urgency exists in the thorough investigation and study of the various problems and areas involved and that no urgent need exists for immediate conclusions. Any position arrived at must be a joint position, arrived at simultaneously. A premature posibion by either of the responsible agencies would unnecessarily complicate and delay the project.

B. (1) The problem of political approval has become increasingly more difficult and complex. Detailed discussions and guidance concerning the following are required.

(a) The most acceptable type of organization to control all of the various aspects of the program.

(b) The most acceptable location for the organization.

(c) Most effective use of the project in support of national policy.

(d) Peace time applications such as disarmament, inspection, all types of surveys and the degree that the project can support the peace time deterrent concept.

(e) The Russian threat to bomb Morinegran and Pakistan air bases if they participated in future U-2 flights and its allocation or significance to U.S. launching bases and T&A stations.

3. Objectives for SAMOS

A. The national importance of timely intelligence is fully recognized. In examining how well SAMOS will contribute to satisfying the intelligence needs of the country the following points must be kept in mind:

: (1) SAMOS will compliment and supplement, but not necessarily replace, other intelligence collection systems and techniques. It should be considered as a very productive and timely adjunct to all other sources.

(2) SAMOS has two major unique characteristics (common to satellite systems) which set it apart from other collection systems:

(a) It is capable of unlimited geographic access with the least risk of major political ramifications.

(b) It is capable of high repetitive world-wide collections in a very time responsive manner.

B. The SAMOS R&D effort is likely to produce, as a result of its R&D testing, intelligence information of a great value which will be reflected in modification of the requirements. The system must not be limited to the support of only military requirements but must be basically responsive to national policies and with the idea in mind to postpone the stringent assignment of particular requirements for an operating system until more is learned of system capabilities, information processing methods, and the realistic requirements for the time period under consideration.

C. Detailed intelligence requirements to be satisfied by SAMOS will be passed to the program by duly constituted authority.

Presently, this duly constituted authority is the Satellite Intelligence Requirements Committee, a subcommittee of the United States Intelligence Board. Depending upon state of the art considerations, the SAMOS Program will be addressed to developing sensors and related equipments to permit the reconnaissance of:

(1) Terrain and culture features of the earth's surface; i.e., visual aspects by photos or other means.

[(2) Electromagnetic emission; i.e., Ferret, Comint, other.]

D. Within these broad reconnaissance areas, the first priority shall be to provide a broad base of coverage over designated large areas of the earth. The resolution or nature of this broad coverage should be compatible with providing this coverage at the earliest possible time. There is the additional requirement to provide surveillance or observance of selected areas on a "more sophisticated" basis in a repetitive manner. Also, sensors must be developed which can collect information which will be useful in assessing technical accomplishments or capabilities of specified nations. The timeliness of the development of these sensors must be emphasized. It must be recognized that the quantities of equipment to process this sensed information is necessary and development must proceed. However, commitment of hardware to manufacture in quantity shall be deferred.

E. Information collected of intelligence value during any portion of the program, including initial R&D take, will be made available to the intelligence community. It is considered to be a mandatory objective of the SAMOS R&D program to collect information of intelligence value as soon as practicable in the flight test program.

4. **Employment (Exploitation) Considerations**

A. If SAMOS reconnaissance is to provide significantly useful results its employment must be centrally controlled in order to be fully integrated with all elements of the national collection system. This operation will include many technically correlated and operationally unique tasks requiring an unusual type and degree of support.

B. A mission as important as this must be given every opportunity to succeed. Therefore, we must fully exploit on a continuing basis the maximum levels of American technology.

C. Coincident with the requirement for special and unique equipment and techniques is the requirement for specially skilled personnel to operate the equipment. Much of the advantage of improved techniques and methodologies can be lost because of the complexities attending the new operations if they come into conflict with G.I. concept.

D. This system,in particular, involving as it does the use of widely varying equipment systems and techniques, does not lend itself to the "standard force" concept of operating personnel. Therefore, careful consideration should be given to the utilization of very skilled technical specialists in combination with experienced and sympathetic operational personnel in every phase of the SAMOS system.

E. The requirement for complex non-standard equipment, specially skilled technical personnel and maximum security to perform the mission at a modest level of effort, are not compatible with standard Air Force organizational and operational concepts. The national importance of the project indicates that authorization to deviate from standard practice must be given as soon as possible.

F. It is not possible, for instance, to take immediate advantage of the state of the art improvements in equipment and techniques on a mass production basis. The standardization of equipment necessary for force-wide use within the Air Force restrict us, time-wise and money-wise, to major equipment improvements, thoroughly tested and programmed, and for the operation of which large numbers of personnel must be trained. On the other hand, certain portions of the system may be subject to some degree of standardization. These must be individually examined and standardization should take place only when it is clearly apparent it will not inhibit the flexibility and capability of the system.

G. Security of the operation is yet another complex problem. For all these - the changing nature and detail of the national requirements, the many unknowns surrounding the full utilization of the unique data collected, the complex and experimental nature of the equipments comprising the system and the combination of special technical and operating skills of the personnel required for sensible system operation - the results, methods and techniques obtained and learned during the planned R&D program, will provide a preliminary yardstick to determine the firm future course of actions.

H. Therefore, the SAMOS Employment Program should be guided by the following considerations:

(1) Remain completely flexible to permit fulfillment of changing requirements (compression of lead time between expression of need and examination of flight results).

(2) Retain ability to incorporate extremely complex experimental equipment into its operations. This means that very close contact with ARDC developers is required.

(3) Be staffed by specially trained, technical personnel in combination with personnel experienced in reconnaissance and intelligence operations. This indicates that a mixed civilian contractor, military R&D team is required.

(4) Integrate closely all elements of the system to provide for high system response and to provide a means of applying maximum security cover to the operation if this is deemed desirable. Likewise, if it is possible that the program may go "white" at some point in time, this compact integration of all system elements will provide the least risk of security compromise to other systems.

PHOTOGRAPHIC REQUIREMENTS

1. There will be a continuing requirement for three types of photographic coverage. As time goes on, the accuracies and detail required will become increasingly greater. In order of priority the types of coverage are listed below:

A. Basic Coverage

(1) Ninety percent coverage of the area of interest is needed now. The resolution or quality of the coverage should be the best possible that can be obtained in the shortest period of time. This coverage will be needed approximately every 6-12 months, depending on the evaluation of the initial take.

(2) This type of coverage at 20' resolution will provide information concerning the new and unknown, allow for the target revisions, allow for extension of existing geodetic control, and provide the information that will allow for more effective and efficient planning as pertains to future operations. It is pointed out at this time that as pertains to the Soviet Union and the United States, the new and unknown has surprised and hurt us the most. On the other hand, the greatest emphasis in our collection efforts is on collecting more information about things we already know something about.

(3) This type of coverage, particularly of selected areas would also be a top priority civilian requirement. It could be used for road, agricultural, reforestration, flood, etc., types of surveys.

B. Mapping Coverage

(1) One hundred percent coverage of the area of interest is desired. Ninety percent coverage is usually considered

to be a successful mapping project. The coverage is required now. The state of the art is such that resolution (100 ll/mm) and geodetic accuracy (300 feet) requirements should not delay efforts toward obtaining the coverage. It is felt that this one time coverage would fulfill the requirement for approximately 6-12 months. In the meantime, evaluation of this initial take, improved guidance and/or weapons systems, technological developments, etc., will determine the relative merits and timing for obtaining coverage with higher resolution and greater geodetic accuracies.

(2) This type of coverage is needed for map and chart revision, targetting, and will also provide information pertaining to new construction, economic growth, cultural changes, etc.

(3) This type of coverage would also fulfill a high priority civilian requirement and lend itself to valuable peaceful utilization as well as propaganda and bargainning purposes.

C. Specific and Technical Type Coverage

(1) This type of coverage requires high quality (ground resolution 1-5 feet or 100-200LL mm system resolution) and large scale (1:150,000). Compared to other systems, the ground area covered is relatively very small in relation to the amount of film used, therefore, operation must be on a very select basis.

(2) This type of coverage of selected targets is required now and would be used for detailed analysis of targets. This type of coverage is also required for the prevention of technological surprise. The frequency of coverage would be once approximately every 12 months.

Timing of the coverage and the targets to be covered should be dependent on the evaluation of the basic and mapping type of coverages.

(3) This type of coverage would have a relatively low civilian priority. It would also be the type of coverage that evokes the strongest type of diplomatic protest. Internationally, the mapping type coverage would more than likely be the most acceptable.

2. The advantages of satellite reconnaissance are that it can cover large areas in short periods of time. The state of the art in the camera development area is such that it is now possible to capitalize on these advantages, i.e., camera performance need not degrade the satellite performance. Utilizing the proper camera equipments it is now possible to obtain basic cover and mapping type coverage of the world effectively and efficiently and in the most economical manner possible. Properly timed and planned, specific type coverage can also be accomplished, in a worthwhile manner (time, effort, and expense as compared to the relative value of the end results), but it must be based on the evaluation of the basic and mapping type coverage.

Effective and efficient satellite operation is dependent upon the type and amount of coverage that can be obtained by the airborne photographic system. Instantaneous coverage is the area of the earth from which usable information can potentially be collected by a given sensor in orbit. Instantaneous coverage from a given altitude can be physically limited for a given sensor by two conditions: (1) the maximum slant range of a sensor, and (2) the minimum angle of incidence of the line of sight to a point on the earth for adequate sensing information. These limitations are called range limited and angle-limited coverage.

The sensing devices used to generate surveillance data will be limited in their range, either by signal power limitations or from resolution considerations. Angle-limited coverage is necessary because of terrain characteristics or atmospheric attenuations.

The effect of the various angles of inclination of the edge of a field of view to the surface of the earth is listed below. The E-1 = 53° for 300 mile oblique swath and 38.4° for 17 mile vertical swath. (Half angle of coverage of the lens is 1.6°, subtracted from 90° results in 38.4°).

	0°	10°	30°	45°	60°	75°	38.4°
Distance visible on the earth's surface 300 mi. altitude.	1300 mi.	1175 mi.	1000 mi.	525 mi.	325 mi.	175 mi.	?
Number of orbits required for complete earth coverage per day at the equator 300 mi. (Polar orbit)	2	4	9	14	35	75	?

The above figures indicate the high degree of compatibility between satellite type of operation and the characteristics of a panoramic type camera capable of covering large areas on each side of the flight path.

If it were required, or desired, to maintain continuous point surveillance and it was possible to obtain horison-to-horizon coverage, eight satellites on four different polar orbits (300 miles) or a total of 32 satellites would be required. This assumes that position of the satellites in respect to each other can be rigidly controlled and maintained.

For the case of sampling the complete earth every revolution, 36 orbits are required with one satellite in each. It is clear that the continuous coverage for early warning requires an entirely different satellite pattern from that of frequent sampling with a limited field of view.

As pertains to the E-2 with a 300 mile swath coverage capability and as it exists today with a 17 mile swath or coverage capability, the following information is listed. Based on weather prediction studies and providing for darkness, the estimated number of satellite days required to obtain a coverage probability of .9 is as follows:

300 Mile Swath		17 Mile Swath	
Summer	Winter	Summer	Winter
11	22	255	441

WARNING

1. The nature of the warning problem is such that it should not be allowed to confuse, justify, or exert technical influence on the reconnaissance satellite system. The various degrees of warning not only imply, but are dependent to a large degree on the known intentions of any potential enemy. Therefore, it cannot be designed for. On the other hand, the importance of early and reliable warning to the national defensive and offensive efforts is recognized. In order to insure the highest quality results, the indicators of the imminence of hostilities should be derived from each and all of the following intelligence categories: (a) scientific and technical, (b) economic, (c) political, (d) military (air, ground and sea), (e) sociological, (f) geographic, (g) transportation and telecommunications, (h) biographical.

2. This, in turn, becomes a national long-term (days-months-years) problem involving all intelligence agencies. Close coordination of all activities and compatibility of all systems is mandatory in order to provide on a timely basis the contributions that SAMOS may make to the above intelligence categories. The urgency of a threat of any situation is dependent on the degree that it is supported by all of the above factors in addition to the extent that counter actions have been taken during the build-up of the situation.

3. The question of timeliness as pertains to the evaluation of the SAMOS end products should be studied very carefully. As pointed out previously, the advantages of satellite reconnaissance are

such that in a very short period of time it can saturate any and all data reduction systems that are now in being. Complete automation of the data reduction process could very easily hinder and slow down the decision process particularly as pertains to the short range - short term problems. Data reduction on a select basis and an effective method to eliminate redundant material is required.

3. E-1 System

The E-1 is a strip camera with a 6" focal length lens designed to operate at 260 statute miles. With the 70 mm format and 100 ll/mm AWAR Av. weighted area modulation it is reasonable to expect a basic ground resolution of 100'. To realize this 100' the IMC must be within 5% because of the long exposure time of 1/25 second. This means altitudes must be accurately known (2 miles) so the proper IMC can be provided for. Since the orbit will be elliptical this point should be studied carefully.

The E-1 system is less complex and much more workable than the E-2 system. Its design makes it a coverage tool. It is felt that it has limited "seeing" of particular targets since the final resolution after readout will optimistically be 300'. Strip cameras are not useful for mapping but approximate measurements of small objects detected is possible. Barring weather considerations, this satellite could cover Russia in twenty days. With weather, one satellite would obtain 40% coverage in twenty days. According to weather study data, it would require 200 days to get 95% of Russia covered, or require ten birds.

The quantitative aspects of the readout problem are not as critical as the E-2 system. The qualitative aspects in terms of degradation due to transmission, reproduction, and system complexity (reliability) are the same as for the E-2.

On the other hand there is an R&D advantage of carry-over value in that the image formation, in flight processing, scanning, transmission, etc., are the same as the E-2. Partial success of the E-1 program could allow for evaluation and future R&D guidance or termination of the readout program before the end of CY-1961.

Recent studies show that recovery systems have gains in information content over readout systems by factors between 260 and 850, depending upon the film width used. Since recovery is best for the reconnaissance content, it must be realized that it is more important for accurate measurement and mapping considerations. The E-1 and E-2 systems claim position accuracies good to one mile, using a strip or panoramic camera, and a television readout with its attendant sweep linearity problems. Experience indicates that this figure is unrealistic.

The problems involved in programming the operation of these satellites are for the most part unknown. Questions pertaining to "start-up" after computer failure and the amount of potential coverage lost during down time are still unanswered. It is not known whether electronic tracking is accurate or timely enough for closely scheduled "camera on" and "camera off" times. The ability to evaluate the end results and correct for slit width, IMC, focus, Yaw, etc., are attendant major problem areas.

The compounding of all of the above mentioned problems in the airborne systems has resulted in an equally complex ground data handling system in an effort to correct many of the anticipated deficiencies.

Read-out Limitation Due to Scan Rate = 6" film per minute

No Read-Out Stations	3	2	1
Read-Out Time/Station (Min/Day)	75	50	25
Film Read-Out/Day			
Inches	396	300	150
Feet	33	25	12.5
Linear Miles/Day	2,790	1,860	930
Sq. Mi./Day	47,430	31,620	15,810
Average Length of Flight Line (Miles)	2,000	2,000	2,000
Average Number of Times Over Each Flight Line to Obtain Coverage		1.07	2.15
(Russian Block=160°) 19.2 M Sq. Mi. No. of Satellite Days Required for Coverage	444	666	1333
Weather Degradation 50%	888	1332	2666
Period Degradation			
Control Degradation			
Reliability Degradation			

Film Size = 2.75"x12.5' (150")
150" ÷ 2.75 = 54.54 (the number 17-mile units in 150")
54.54x17 = 930 (linear miles forward direction)
Single frame = 17 mi x 930 mi or 15,810 sq. mi.

In comparison a 70mm recovery system will cover 278,000 sq.mi./day and 16,000 linear mi/day. The number of satellite days required to obtain total coverage would be 72. Degraded 50% for weather the total would be 144. Degradation due to period, control and reliability is not as great or as critical because of the fewer number of days required. If the satellite is recovered in a 24-hour period, it will show a gain of 6 to 18 because of the read-out limitations.

Using a panoramic recoverable system with the capability of a 150-mile swath, the comparison would be:

16,000 linear miles/day

2.4 M square miles/day

8½ satellite days would be required to obtain coverage

17 satellite days would be required if weather were considered

The degradation due to period, lack of control, and reliability would be substantially less because of the wider area of coverage obtained resulting in a fewer number of vehicles requiring a fewer number of days to obtain coverage.

(19 May 1960)

LAUNCH SCHEDULE

	1959			1960			1961		1962		1963		1964	
	Dis.	Dev.P.	Dev/O	Dis.	Dev.P.	Dev/O	Dev.P.	Dev/O	Dev.P.	Dev.O	Dev.P.	Dev/O	Dev. P.	Dev/O
JAN.	1			1			E-1) 1 F-1)		1 F-2		1 E-2			1 E-2
FEB.	1			2					1 E-2			1 F-2 1 E-2		1 F-2 1 E-2
MAR.				2					1 F-2 1 E-5		1 E-2			1 E-2
APRIL	1			2			1 E-2		1 E-2			1 E-5		1 E-5 1 E-2
MAY				2					1 E-5		1 E-2	1 F-2 1 E-2		1 F-2 1 E-2
JUNE	2			2			1 F-2		1 E-5			1 E-2		1 E-2
JULY				1					1 F-3	1 F-2	1 E-2	1 E-2		1 E-2
AUGUST	2			2			1 E-2		1 E-2			1 F-2 1 E-2 1 E-5		1 E-2 1 F-2 1 E-5
SEPT.				2	1:F-1) E-1)		1 E-5		1 E-2 1 E-5		1 E-2			
OCT.				2			1 F-2		1 F-3			1 E-2		1 E-2
NOV.	2			2	1:E-1) F-1)		1 E-2		1 F-3 1 E-5	1 F-2	1 E-2	1 F-2 1 E-2		1 F-2 1 E-2
DEC.							1 E-5		1 E-2	1 E-5	1 E-2	1 E-5 1 E-2		1 E-5 1 E-2
TOTALS:	9	-	-	20	2	-	8	-	15	3	7	15	-	18
							3- E-2 2- E-5 1- Comp. 2- F-2		3- F-3 2- F-2 5- E-2 5- E-5	2- F-2 1- E-5		4- F-2 8- E-2 3- E-5		11- E-2 3- E-5 4- F-2

Note: The Hand-out (Briefing Aids) that BMD used in last briefing are not consistent with the Dev/P or Dev/O publications that DDR&E is studying and/or approving. Information in Hqs, USAF is sparse.

D/O: E-5, one every fourth month
F-2, one every third month
E-2, one a month as possible

Subsystem I

The SAMOS Processing Subsystem, SS I, has been under close scrutiny by DDR&E during the past 12 months. The most fundamental question of this phase of the program centers on the matter of the realism of the goals and concepts outlined by the Air Force in the "operation or exploitation" of the system. It is recognized that the SAMOS Program (under its various designations) is a program of considerable tenure with certain resources in place and many developments essentially committed to completion. The guidance offered should be tempered with this consideration.

The factors discussed in other sections of this paper under Political considerations, Employment considerations, Objectives and Requirements all have their direct impact on the nature and direction of the SS I R&D program, as well as the manner in which it is planned to process the "take" from the R&D flights.

The development concepts and program goals for these two areas are discussed and delineated below.

1. DEVELOPMENT CONSIDERATIONS AND GUIDANCE

It is of the highest priority for this system to satisfy critical collection requirements at the earliest time. The means by which this requirement is met, so far as the agency operating the devices or the development status of the system, is unimportant in satisfying the requirement. Thus, there is latitude to depart from the classical system development approaches and to depart from classical military planning for the deployment of the system, particularly since:

A. It is evident that the over-riding problem for at least the ensuing few years will continue to be the development problem due to the uniqueness of the unattended satellite platform as a collection system. This has required advances in the state of the art during the past years. Many of these advancements, although presently incorporated in the system design, are yet not thoroughly proven and are critical to the satisfactory routine performance of the system.

B. The nature of the intelligence mission requires flexibility of operation with multi and/or adaptable sensors. It is improbable that any model of sensor will be serially produced in large quantities. Job shop production and special handling may be expected to key note the preparation of sensors for some time to come.

C. The types of information, collectable, information rates, scales and scope of photographic coverage, high coverage repetition rates for both visual and electronic sensors, and the geo-time correlatable nature of mixed sensor information, are relatively new and unique. Carefully controlled experimentation and study of both the collection and the analysis functions must be conducted during the R&D period with test results to determine the best methods of employment and information processing prior to the establishment of firm operational doctrine and procedures. Dual development approaches are necessary in many areas in order to optimize and/or assure success of the system. The selection of single approaches should be postponed until appropriate feasibility and reliability can be demonstrated. Standardization, design freezes and other "over control" during development can only inhibit the efficient development of this unique system.

Although automated processes are important to statistical analysis and mensuration, particularly as involved in triangulation, bridging, etc., photographic interpretation is still very much an art depending upon the experience, knowledge and skill of the technician. Therefore, automated devices should provide assists to the P.I. in numerical handling fields and cautiously avoid limiting his flexibility in photo interpretation by slaving him to an automatic cycling procedure.

The pacing nature of the development program, the inability to define fully the requirements for exploitation of the system, and the requirement for flexibility in the sensors, gives the strong indication that the SAMOS system will have an "R&D complexion" for some time to come and if not throughout its life. Therefore, the stringent assignment of particular requirements for an "operating system" should be postponed until more is learned of system capabilities, information processing methods and the realistic requirements for the time period under consideration. However, maximum effort and resources must be assigned to the task of collecting and disseminating without delay the maximum possible amount of intelligence information throughout all phases of the development program. Specifically, this translates to the SS I Development Program in the following manner:

(1) Equipment to process the data collected during the R&D program is necessary and development must proceed. However, commitment of hardware to manufacture in quantity will be time phased to meet only the collection capabilities described by the R&D launch schedule

on a non-time critical basis for through put.

(2) System design and equipment developments must remain flexible enough to accommodate sensor changes of format and type without major system upheaval.

(3) System design and equipment development should not be based upon premature commitment to firm operational system requirements. The program should remain geared to experimentation and controlled testing to provide the basis for determining "worth" factors and future operational planning exercises. The extremely costly operational ground stations and exploitation plan of SAMOS must not impose rigidity on future systems which will more completely fulfill national intelligence goals.

(4) Development program should take into account needs of intelligence uses in order that equipments developed and system outputs will be useful to other elements of the intelligence community.

(5) All extra AF elements of the intelligence community (Army, Navy, CIA, etc.) should participate in the system R&D simulation and testing to better understand the system and to contribute to the overall development goals and test evaluations.

2. INITIAL EXPLOITATION AND SUBSEQUENT SAMOS DEPLOYMENT

A. Outline or Initial Exploitation of R&D Take

The general SAMOS exploitation plan can and should remain flexible while the system "worth" factors are being experimentally determined. This flexibility should not adversely effect the processing of the raw intelligence collected and will provide the basis for the orderly establishment of information flow requirements, mission planning mechanisms and over-all system operational employment (frequency of coverage, type of sensor control and phasing, utility of products for other than "military planning" purposes). It is appropriate that all payload flight data collected be handled as useful raw intelligence data, beginning with the first payloads flown as R&D flights and continuing throughout the planned test program, as well as future follow-on flights. This material will be initially processed (1) within a suitably prepared area in the government owned Satellite Test Center (STC) facility at Sunnyvale, California, and the results of the processing placed as soon as possible into intelligence channels as source material for further exploitation by all intelligence users. At the outset, ARDC will be the organization responsible for system development and test including the initial processing. At the earliest feasible time during the system R&D test period, representatives of the intelligence community should participate under ARDC cognizance to assist in the early exploitation of the test results and participate in the study and analysis work being conducted.

(1) This initial processing is defined as Phase I process and which will be described subsequently in this document.

B. Plan for Initial Exploitation and Subsequent SAMOS Deployment

(1) General Exploitation

(a) The SAMOS Processing Subsystem (SS I) development effort will provide the necessary equipments, techniques and methods to insure that the capability for performing the Phase I processing functions noted below is sufficient; such that execution of these functions will not limit exploitation of the satellite reconnaissance capability. It provides for the link between the SAMOS collection system, the network of system ground complexes and the intelligence production agencies. The development program is established which will determine, through experimentation and test, the eventual capability desired for the general concept of operations described herein. This development program includes a test and development laboratory where a program of controlled tests is presently being developed to accomplish much of the work on SAMOS data processing techniques and analysis noted above. This program should use both simulated inputs and real data derived from the flight test program. The laboratory of test equipment and skilled technical people will form a basic element in the processing of all recon data gained through the R&D test program.

(b) There is strong, continuing political need to disassociate the operating organization from aggressive or combat implications during and subsequent to the accomplishment of the R&D test phase. Therefore, the executive management responsibility for the overall assembly, checkout, launch, tracking, command-readout-recovery functions of the system are to be vested in ARDC, which is a command with no combat potential. There is foreseen the possible need in that period for the establishment of a National Satellite Information Processing Center (NSIPC) jointly staffed by all interest elements of the intelligence community.

The realistic determination of the need, as well as the detailed planning and programming for the NSIPC, should result from the data and experience gained through the system experimentation, simulation testing, and processing evaluations conducted during the R&D program at the STC. ARDC's responsibility for the processing function will extend through the complete R&D period (as executive managers of the joint participation program to reduce the R&D flight data) to include the joint preparation of justification studies and plans for the NSIPC. Within the context of a joint operational NSIPC, ARDC's responsibility will revert solely to insuring the technical functioning of the system.

(c) In this operational period the actual detailed mission planning and intelligence processing will be accomplished within the National Satellite Information Processing Center in response to the general requirements imposed by the USIB SIRC Committee in Washington. Direct distribution to all Department of Defense agencies of all satellite derived materials will be made from the NSIPC through their in-residence representatives. It is conceivable that the SIRC organization may eventually require a direct tie into the NSIPC for the purpose of receiving slaved positional displays, maintaining mission progress and a required means of receiving significant video information.

C. Scope of SS I Processing

(1) Conceptually, the processing of SAMOS derived data will be accomplished in three separate but related phases. Phase I is the initial mission review processing which is tied to the SAMOS system and is expected to be accomplished at the SAMOS Center, at the STC

during the R&D program, and evenutally at the NSIPC in the later phases. Phases II and III and those processing functions subsequent to Phase I which are expected to be accomplished outside SAMOS Center and within the organizations of the many diverse recipients of SAMOS information.

(a) Phase I - functions will be those required to accomplish the steps below and to produce and disseminate the results on a timely basis.

1. Rapid screening and interpretation of large quantities of raw photographic and elint material for the selection and culling out of time-significant data. Such selection will be based on a prior requests and on "significant changes" detection by comparison of new data with previously collected SAMOS information, graphics and other intelligence reference material.

2. Orderly processing, reproduction and dissemination of select SAMOS source data as required by all the intelligence production agencies for their own internal exploitation.

3. Analysis of the collected data to provide feedback information required for efficient system operation and control. This includes deriving and presenting information needed for quality control of the positioning and sensory equipment as well as assessing over-all mission fulfillment.

(b) Phase II - processing and exploitation will produce:

1. Studies that result from detailed search, analysis, and evaluation of all-source material.

2. Graphics suchas topographic maps, geodetic data sheets and air navigation and target materials.

(c) Phase III - Themerging of SAMOS with all source data for analysis and evaluations resulting in NIE's, Technical Intelligence, etc.

The Subsystem I development program is limited in scope to the Phase I level of data processing. Subsystem I is being designed and developed as an entity to provide the government with the means to centrally accomplish the Phase I processing of SAMOS collected data in close harmony with the other ground and control portions of the SAMOS system in order to minimize total processing and communication requirements and to insure most efficient SAMOS system operations. Although the capability being developed is an integrated system it contains elements which can be duplicated, if desired, in a subsequent buying program for accomplishing elements of Phases II and III type processing functions at diverse physical and organizational locations. The output products and formats of Subsystem I will be in a form compatible with present and in-development unit equipments for Phase II and Phase III processing. Where Phase II and Phase III processing operations are being developmentally aided by other procurement and development programs, ARDC will continue to insure compatibility of data flow between systems.

2. INPUTS TO PHASE I PROCESSING

A. This describes the inputs resulting from the payloads presently under development. The Subsystem I development program is plan phased to the R&D launch schedule. Inputs into the center from outside SAMOS [illegible], requests, etc.) may be generated through the USIB Satellite Intelligence Requirements Committee down through the agency exercising operational control over the national processing center and the system. Inputs to the center from within: MOS will be generated at the TAA stations and will be forwarded directly via land lines to the center. These will consist of orbital tracking data, telemetry and calibration data in addition to the entirety of the raw reconnaissance information. Inputs to Subsystem I specifically includes: navigation data in digital form on magnetic tape for the particular satellite of concern which is correlatable to the raw recon data by a time and satellite identification index.

(1) 35mm photographic stripe termed primary records, unidentified except for fixed leader information and a time correlatable index. Included hereon are also small photographs of the horizon which must be interpreted to ascertain the attitude of the platform at the time of camera operation. With the 36" focal length camera system and with three readout stations commissioned, a total readout time per day of 72 minutes will exist. The system will be capable of producing 55,000-60,000 square miles of selected ground coverage/satellite day at that time.

(2) From the SAMOS recovery program an additional photographic input to Subsystem I will be up to 50,000' of exposed undeveloped 5" wide high resolution (115 line/mm) film.

(3) Raw uncalibrated elint signals on magnetic tape, accompanied by calibration tables and significant telemetry data. This will include an estimated number of 15,000 intercepts/satellite day, 2400 of which may require examination during the processing.

3. OUTPUTS OF PHASE I PROCESSING

A. The outputs of SAMOS will be prepared for initial direct dissemination to intelligence agencies in accordance with SIRC directives. The system outputs will include:

(1) Transcriptions of the incoming records into formats which will be usable without special equipment in intelligence agencies for Phase II and Phase III processing. To provide these the raw recon data is processed and screened for quality and correlated with navigation data. The attitude information is used to further refine the geographical position and the ferret data is fully calibrated. These products will include:

(a) Titled duplicate transparencies of the original photo records in both positive and negative forms.

(b) Selected and titled photography on a 9½" wide format at approximately 20 lines/mm.

(c) Minimum numbers of selected and titled rectified and unrectified prints.

(d) Duplicates of ferret magnetic tape records. Digital data will be encoded directly for use in user data processing equipments.

(2) Initial screening and interpretations of the recon records. This will be directed toward reporting significant information which may contribute to the determination of activity level of Soviet Bloc forces.

(3) Accurate positional data of ground control points used in titling, indexing and improving orbital data.

(4) Reports of new and unusual activities derived from electromagnetic intercept and visual data.

(5) Collection control data based on directed intelligence requirements and mission assessment for the programming of the SAMOS sensors.

(6) Quality control feedback including calibration data to other sections of the SAMOS system.

(7) Mission review reports and summaries.

4. FUNCTIONAL DESCRIPTION

A. The major center functions needed for Phase I processing to produce the above outputs and to operate the over-all system in an orderly manner include selected elements of:

(1) Photo processing
(2) Photogrammetry
(3) Photo interpretation
(4) Ferret analysis
(5) Automatic data processing and computation
(6) Display and intra-communication of information
(7) Scheduling and control of information flow and processing execution.
(8) Computation of information relating to system operation
(9) Storage and retrieval of information

5. PHOTO PROCESSING

A. Data collected by each pass of a photographic vehicle is received at the SAMOS Center as a wire transmission from a T&A station or batches of primary records physically transported from the T&A stations and recovered capsule cannisters of exposed undeveloped high resolution film. The information is transferred and recorded on film (primary records). Many of the center's operations and the agencies it distributes source material to require photo data in different form and size than the 35mm 18" long striplets of the primary record. It, therefore, goes through a number of processing steps upon receipt.

B. The SAMOS recovery program further requires the developing and processing of large batches of 5" wide, high resolution film.

6. PHOTOGRAMMETRY

Photogrammetry is performed on cover from photo vehicles to aid in the identification of the areas photographed for the film plotting, titling and indexing operations as well as for feedback to improve the orbital information.

7. PHOTO INTERPRETATION

Cover obtained by photographic vehicles is screened and interpreted by P.I.'s to identify and report objectives of immediate intelligence interest. In addition, mission assessment is made and the photography is examined in detail to determine characteristics of the system performance.

8. FERRET DATA ANALYSIS

Electronic intelligence data telemetered from ferret vehicles is received by the SAMOS Center from the T&A stations (the same stations that collect the photographic-vehicle data), in the form of binary-coded and analog wire messages. This data, which includes communication intercepts as well as radar intercepts, are immediately transferred to magnetic tape in preparation for processing. Part of the ferret data processing is automatic; the rest is semi-automatic and is done by the computer with the assistance of an analyst. Reports are prepared on electronic activity and copies of both digital and analog tapes are made for using agencies.

9. DATA PROCESSING AND INFORMATION STORAGE

Most of the data processing and storage and retrieval of information is done by the "Central Data Processor." This is a flexible electronic computing system to which most of the other equipment in the center is directly connected. Operators in the center can communicate directly with the Central Data Processor to enter data into the computing system and to obtain information from it in the form of displays and print-outs.

10. DISPLAYS

To assist various operators and to give Center Control information it needs for its decision-making functions pertaining to system control and operation. A number of visual displays can be generated and kept up-to-date with information stores in the Central Data Processor.

11. PROCESSING CONTROL

The basic functions are workload programming, evaluation of the processing operations and results, and general management of the Center operations.

12. CENTRAL PHOTO STORE

A semi-automatic store of SAMOS photo take plus required selected photo reference material is stored in the form of center format film chips. These chips have unique maching readable numbers which are cross referenced inside the Central Data Processor and can be recalled as requested by analysts by input to the Central Data Processor.